## Remarks

By the above amendment, Applicant has cancelled all previously existing claims and rewritten all claims to define the invention more clearly, particularly and distinctly so as to overcome the technical rejections, and define the invention patentable over the prior art.

New claims 21-25 and 26-29 are amended from claims 1-5 and 12-15, respectively. Claim 30 is amended from claims 17-18. Claim 32 is amended from claim 19. Claims 31 and 33-34 are new.

## I . Response to the Claim Rejections – 35 USC §112

**All comments regarding 35 U.S.C. 112 have been taken into amending claims to overcome the rejections under 35 U.S.C. 112**. The last O.A. rejected Claims 1-5, 7-10, 12-15 and 17-19 under 35 U.S.C. 112., as being indefinite. These claims have been canceled and rewritten as the new claims to take the comments into account to overcome the rejection. **Applicant thanks the Examiner for all his constructive comments and help.** Applicant respectfully requests reconsideration of this rejection, as now applicable to claims 21-25, 26-29 and 30-31, for the following reasons:

1. The last O.A. comments that "Claim 1 is unclear what is meant by 'diameter/shape' – it is unclear if it requires both or either of the two."

   Now, claim 21 clearly states it as "either the outer diameter or geometrical shape parameter of a preform".

   This amendment has also been taken into Claims 22-23 correspondingly.

2. Claim 22 rewrites the phrase of "the measured data are" in claim 2 by the phrase of "the measured diameter or geometrical parameter is".

3. The last O.A. comments that "Claim 3, line 3 refers to 'either' one: but then three things are listed. ... One suggestion is to use the following language ...".

   In claim 23, the suggested amendment has been taken into account as "wherein the control process controls at least one member of the group comprising: a feeding speed control of said preform, a drawing speed control of said optical fiber, and a tension control of said

optical fiber."

4. The O.A. comments that "Claim 4 there is no antecedent basis for 'the heating and melting device.' The claim also refers to drawing and providing steps (and maybe others) it is unclear if they refer to the drawing and providing of claim 1, or if they require additional drawing and providing steps."

   New claim 24 recites "at a position below the furnace" to replace "at a safe position below and close to the heating and melting device" in claim 4. That furnace is the one in claim 21 as added.

5. The O.A. comments that "Claim 5: lines 6-7 refers to 'the measurement data'; it is impossible to infer if such refers to the data of claim 1, or the data of claim 5, line 4. Also, there is no antecedent basis for their respective preselected outer diameters."

   The phrase "the drawing being carried out at a drawing rate that is controlled based on the measurement data and the deviations of the measured preform outer diameter and the measured optical fiber outer diameter from their respective preselected outer diameters" in claim 5 has been replaced in Claim 25 as follows:

   > "generating control signals to control a drawing speed of said fiber from the melting preform and a feeding speed of said preform into the furnace,
   >
   > based on the measured perform outer diameter or geometrical shape parameter, its deviation from a preselected nominal preform diameter or parameter, said nominal preform diameter or parameter, the measured optical fiber outer diameter, its deviation from a preselected nominal fiber outer diameter, and said nominal fiber diameter".

   This comment has also been take into account in new claim 27 amended from claim 13.

6. The O.A. also comments on claim 7. Claim 7 has been canceled. However, the comments have been taken into account for attention to write new claims in this amendment.

7. The O.A. comments that "The other claims have similar problems. Applicant is REQUIRED to correct all such problems."

   All previous claims have be canceled, rewritten and amended as the new claims to follow the above requirement and to solve the similar problems.

## II. Brief Summary of the References and Differences of the Present Invention

Before discussing the claims and the references regarding 35 U.S.C. 102 and 103, applicant will first discuss the references and the general novelty of the present invention and its unobviousness over the references by a brief summary of the references, the present invention, and their differences as follows:

**The Present Invention** for the optical fiber drawing process has the general novelty including:

(a) measuring the outer diameter or geometrical parameter of a *preform*;

(b) measuring the outer diameter of a *bare* optical fiber at *two* different locations between the heating and the coating;

(c) generating *two* different *bare* fiber diameter measurement *sets* from these two different measurement locations;

(d) a preform feeding speed control using the measured preform dynamic diameter or parameter data;

(e) a fiber drawing speed control using the measured preform dynamic diameter or parameter data;

(f) a tension control using the measured preform dynamic diameter or parameter data;

(g) the preform feeding speed control utilizing the measured two different bare fiber diameter data sets from the two different locations;

(h) the fiber drawing speed control utilizing the measured two different bare fiber diameter data sets from the two different locations;

(i) the tension control utilizing the measured two different bare fiber diameter data sets from the two different locations;

(j) measuring the outer diameter of a bare fiber at a location at which the *shrinkage* of the bare fiber while stretched is *not larger than* a predetermined *allowable bare fiber diameter deviation value* of said optical fiber, *or immediately before* the *coating*, to make a final bare fiber diameter measurement;

(k) *a new robust control method and operation principle* using measured preform outer diameter ($D+\Delta D$), its deviation ($\Delta D$) form a predetermined nominal value ($D$), and this nominal value ($D$), as revealed in the specification of the present invention, especially in algorithm (3) (page 17, paragraph 0067) and paragraph 0044 in pages 10-11, to maintain

a robust fiber drawing process control against the deviations and variations of the preform diameters and shapes, disturbances, environment and process parameters changes, and to make a robust performance control of the final bare fiber outer diameter.

**Harding** (GB) US 4,793,840 teaches optical fiber manufacture in which only one fiber diameter monitor 9 measures the optical fiber diameter and that monitor location refers to their British patent application No. 8323692 (GB 2146321). This only diameter measurement monitor 26 in GB 2146321, i.e., monitor 9 in Harding locates below and close to furnace 24 in GB 2146321A, i.e., furnace 3 in Harding, as shown in Fig. 1 in GB 2146321. The Harding's optical fiber manufacture method has no above substantial physical features (a)-(k) of the applicant's present invention.

**Urruti** (US) US 5,551,967 teaches a method for controlling fiber diameter during drawing in which two measurements of fiber diameter are made and combined into an overall control signal. However, the only one measurement 52 is made on the bare fiber diameter before hermetric coater 54 and protective coater 56. In the bare fiber measurement, it is as the same as Harding's one measurement of the bare fiber. His new second measurement 60 of the coated fiber diameter is between coater 54 and coater 56, i.e., after coater 54 and the coating. Thus, this second measurement needs a technique operable in the presence of such a coating as stated. This technique is more complex than a bare fiber diameter measurement technique.

It is just as the same as discussed by Urruti US 5,443,610 that is cited and discussed in the specification of the present invention (page 6, paragraph 0023; page 18, paragraph 0074; page 21, paragraph 0089). Urruti US 5551967 is the division patent of his US 5443610. The Urruti references US 5551967 and 5443610 are lack of the above substantial physical features (a)-(k) of the applicant's present invention.

**Pilkington** (GB) GB 2,238,536 teaches a preform manufacturing process to increase the outer diameter of the preform with repeatly sleeving tubers into initial preforms. It is a different process with different scope and content. It does not measure the tube outer diameter for a slight stretch control. The tube diameter of the preform-and-tube assembly is the final perform outer diameter for the fiber drawing process. The role of the tube diameter during the Pilkington process is equivalent to the role of the preform diameter during the fiber drawing process.

Pilkington does not teach the measurement, as the O.A. mentioned. Of course, he especially does not teach the measurement for the fiber drawing process. Thus, Pilkington is obviously lack of the above substantial physical features (a)-(k) of the applicant's present invention of the robust diameter controlled optical fiber drawing process.

**Kenmochi** (JP) US 6,178,778 teaches a fiber drawing process with monitoring the diameter at two locations, but using three measurement devices, two for measuring the fiber in the furnace, and one for measuring the fiber after the heating. Thus, it misses the above substantial physical features (a)-(k) of the applicant's present invention.

**Gansicke** (DE) US 6,516,636 teaches a method to manufacture a quartz glass tube with one outer diameter measurement in the furnace and another measurement after the heating. It is a different process with different scope and content. Furthermove, Gansicke does not have the above substantial physical features (a)-(k) of the applicant's present invention.

**Roba** (IT) US 6,371,394 teaches a method for winding a fiber with different longitudinal positions and characteristics on a support with different pitch values. It has one diameter measurement after the heating and above the coating, one after the first coating and before the second coating, and one after the second coating. Therefore, it clearly misses the above substantial physical features (a)-(k) of the applicant's present invention.

## III. The Response to the Claim Rejections – 35 USC § 102

### A. Applicant Thanks the Examiner's Notice and Comment on Dependent Claim 10, that helps to write its Distinguished Feature Clearly in the Amendment.

Claim 10 has been canceled. However, this comment has been taken into account on a corresponding modification for clarity on related new claims 26 and 32.

1. The O.A. comments on claim 10 that "It is noticed that it appears that Applicant intends to claim two different sets of outer diameters – however, the claim does not provide much or any difference between the two diameters being used. In other words, the claims are very broad and read on only one diameter measurement device."
2. The above comment has been taken into account. **A corresponding modification** is

"measuring the outer diameters of said optical fiber, which is bare before coating, at two or more different locations by respective measurement devices before the coating; ...

producing different measurement data sets of the bare fiber respectively from the different locations; and

providing a control system with the different measurement data sets to control said drawing process".

3. This modification has been taken into new related claim 26 amended from claim 12.
4. This comment has also been taken into account for new claim 32 that is rewritten from claim 19.

**B. Claims 26-27, 30 and 32 Distinguish from and Are Patentable over Urruti 5551967**

The last O.A. rejected claims 12-13, 17 and 19 on Urruti. Claims 12-13, 17 and 19 have been canceled. Claims 12-13 and 19 have been rewritten as new Claim 26-27, and 32, respectively, that patentably define over Urruti. Claims 17 and 18 have been combined and rewritten as new claim 30. Applicant respectfully requests reconsideration of this rejection, as now applicable to claim 26-27, 30 and 32, for the following reasons:

1. **Claims 26-27, 30 and 32 have substantial physical and manipulative feature differences that significantly distinguish from and are patentable over Urruti 5551967.**

Specifically, **claim 26** recites:

"measuring the outer diameters of said optical fiber, which is *bare before the coating*, at *two or more different locations* ".

Dependent **claim 27** of claim 26 further recites:

"a second position, below the first position, at which shrinkage of the outer diameter of said optical fiber, while stretched under the drawing, is not larger than a predetermined allowable bare fiber diameter deviation value of said optical fiber, or immediately before the coating".

**Claim 30** recites:

"measuring a preform outer diameter ... ...

calculating a preform diameter deviation of the measured preform diameter from a preselected nominal preform diameter value, and a fiber diameter deviation of the measured fiber diameter from a preselected nominal fiber diameter value;

generating control signals based on the preform deviation and the fiber deviation for said optical fiber drawing process control; and

adjusting the feeding speed of said preform and the drawing speed of said fiber as said control signals command".

Dependent **claim 32** of claim 30 further recites:

"locating a second bare fiber outer diameter measurement device after the first bare fiber measurement device and before a coating device in which the fiber is coated; ...

calculating a second bare fiber diameter deviation of the measured second bare fiber diameter from a preselected second nominal fiber diameter value which is less than the first nominal fiber diameter value;

said control signals are further based on this second bare fiber diameter deviation".

Urruti 5551967 teaches only one measurement of the bare fiber before any coating. Its second measurement is made just after his coater 54 for a coated fiber, not a bare fiber.

He does not show two different measurement locations of the bare fiber between the heating and the coating.

Urruti 5551967 doest not teach the preform measurement and the new control method principle as recited above.

Therefore, Urruti 5551967 does not show the substantial physical features in claims 26-27, 30 and 32 in the present invention.

**These recited sentences of claims 26-27, 30 and 32 patentably distinguish them from Urruti 5551967.**

2. For **a further clarity of novelty**, claim 12 is further amended **into new claim 26** with

manipulative features that Urruti 5551967 does not show as follows:

"*producing different measurement data sets of the bare fiber* respectively from the different locations; ... ...".

3. As stated above, **claim 27** is a dependent claim of claim 26 to further restrict two different measurement locations, and to define calculation of the deviations of the two measurement data sets, and a dynamical control of the fiber drawing speed and the preofrm feeding speed based on the deviations of said two measurement data sets from their respective preselected values.

4. As stated above, **claim 32** is further amended from claim 19 as a dependent claim of claim 30 from claims 17-18. Thus, the dependent claim 32 has novel physical features from new claim 30 based on claim 18, including a preform measurement and its novel operation principle in claim 30:

   a. "measuring a preform";

   b. "calculating a preform diameter deviation of the measured preform diameter from a preselected nominal preform diameter value, and ... ...";

   c. generating control signals based on the preform deviation and the fiber deviation for said optical fiber drawing process control;

   and in claim 32 itself,

   d. the second measurement of the bare fiber diameter; and

   e. its corresponding different control principle utilizing the second (final) bare fiber measurement.

5. The last O.A. comments that "See col. 4, lines 33-67. The first measurement is made just after furnace 50, the second measurement is mad just prior to coater 56. The process is of sufficiently high robustness to satisfy Urruti."

   However, *lines 60-66 in column 4 of Urruti 5551967 read that* "The second diameter measurement is made between hermetic coater 54 and protective coater 56. ... ... Since the fiber has been hermetically-coated at this point, the technique used for this measurement must be operable in the presence of such a coating."

Therefore, it is clear that *the second measurement of Urruti is made after coater 54.* It measures a *coated* fiber, *not a bare* fiber. Furthermore, *his measurement technique must be operable in the presence of such a coating*, as he stated.

However, **in the present invention, the second measurement of a *bare* fiber is before the coating**, i.e., a bare fiber at this point. It not only provides an accurate measurement of the final bare fiber diameter, but also simplifies the measurement technique.

By the comparison, the present invention not only has an accurate measurement of a final bare fiber diameter, but also saves valuable calculation time and memory storage space during the calculation in the process control, and also reduces the control reaction lag. It is especially important in this complex optical fiber drawing process. Thus, the present invention has stronger robustness in both stability and performance than the prior art.

6. **The specification of the present invention has discussed its novel physical and manipulative features substantially different from Urruti US 5443610 which is the parent patent of the division patent Urruti 5551967.** Thus, the present invention, as claimed, has the novel physical and manipulative features substantially different from the division patent Urruti 5551967 such as stated above.

7. **These novel physical and manipulative features of claims 26-27, 30 and 32 make new results as robustness to control the required bare fiber diameter against various disturbances, perturbations and deviations,** because of the twice bare fiber measurements method, especially including the final bare fiber measurement and the different control operation principles.

8. **Claims 26-27, 30 and 32 are unobvious over Urruti 5551967 as to be discussed below in** IV. D – IV. F.

## IV. The Response to Claim Rejections – 35 USC § 103

### A. Claim 21 is Unobvious and Patentable Over Pilkington GB 2238536.

The last O.A. rejected independent claim 1 on Pilkington under 35 U.S.C. 103(a). Claim 1 has been rewritten as new claim 21 that defines the patentable and unobvious subject matter

over Pilkington. Applicant respectfully requests reconsideration of this rejection, as now applicable to claim 21, for the following reasons:

1. ***Different Scope and Content* of the prior art Pilkington**:

   Pilkington GB 2238536 is for manufacturing performs by repeat sleeving and collapsing the tubes onto the initial preform to increase its size and maintain the concentricity.

   It is a different manufacturing process from the fiber drawing process. His innovation mainly is the sleeving processes through the successive addition of the commercial tubes and the technique to maintain high centricity by the rod R. Therefore, it is clear that Pilkington has different scope and content from the present invention which is for the fiber drawing process.

2. ***Differences between the present invention and Pilkington***:

   i. As the O.A. mentioned, Pilkington does not teach measurement.

   ii. Pilkington clearly does not teach and does not imply to measure the real preform outer diameter that should be its tube diameter.

   iii. The present invention is a new fiber drawing process that is totally different from Pilkington's process.

   iv. The present invention uses the final preform outer diameter measurement for the fiber drawing process control, however Pilkington does not.

   v. That fiber drawing process control includes a preform feeding speed control, a fiber drawing speed control and a fiber tensor control, however, which Pilkington does not have.

3. ***The proposed modification to simultaneously perform*** *the Pilkington process with the drawing down of the preform-and-tube assembly into optical fiber* ***is inoperative and destroys the intended operation and the reference goal – productivity and "greatest efficiency"***, as described as follows:

   i. The proposed modification, that "the step of collapsing the tube onto the preform may be performed simultaneously with the drawing down of the preform-and-tube assembly into optical fiber", will not be suitable for and will destroy mass production because:

- Pilkington's preform process is a repeat process;
- Its repeat process is using the same apparatus. Lines 10-15 of page 5 in Pilkington read "The process is optionally continued, using the same apparatus, ... . Each of these further performs may then be built up in a similar manner, by the addition of one or more silica tubes of standard dimensions."
- The fiber drawing process had to wait for finishing this repeat process before starting the fiber drawing process.

ii. Moreover, its process can not be directly and simultaneously combined with the fiber drawing process because its bottom Rod (R) should be removed from the final top preform before the fiber drawing process starts. So, *it can not be simultaneously drawing fiber from the final preform* (preform-and-tube assembly) while collapsing the final tube onto the initial-preofrm. The Rod has no optical core and can not build the required optical fiber.

iii. Thus, it is clear that the proposed modification or combination will not be efficient.

iv. It will destroy the reference goal – productivity and mass production.

v. Furthermore, the proposed modification would be inoperative if it were simultaneously to perform a fiber drawing process from the preform-and-tube (P-T) assembly with the rob (R) in the Pilkington's process.

4. ***Claimed features lacking***. *Pilkington GB 2238536 lacks the following substantial manipulative features claimed in Claim 21:*

i. *measuring* either the outer diameter or geometrical shape parameter of a *(final) preform*, i.e., its *tube*, for either the fiber drawing process or the Pilkingotn manufacturing process;

ii. while heating and melting, *drawing said optical fiber* from said preform under tension to form said optical fiber; and

iii. *providing a control system* with the measured outer diameter or the geometrical shape parameter of said preform to control said drawing process.

Furthermore, the fiber drawing process is a *large stretch* and has dramatic change of its size, totally different from the Pilkington process.

5. The last O.A. comments that "Claim 1 'diameter/shape' is being interpreted as 'diameter or shape'. It is unclear if Pilkington teaches a step of measuring the outermost diameter. However, from page 3, lines 13-14, 25-31, and page 7, lines 1-8 (which teach stretching the preform to correct variations in diameter of the preform P) it would have been obvious to measure the outer diameter at various locations so that one will know the amount of stretching to apply at the locations."

***It is noticed that Pilkington clearly does not teach a step of measuring the outermost diameter of final preform in his whole specification, including its page 3, lines 13-14, 25-31 and page 7, lines 1-8.***

First, it should be clear that the preform in the fiber drawing process is the final preform, i.e., preform-and-tube assembly, in Pilkingotn's preform manufacturing process.

Second, in Pilkington, the final preform outer diameter should be its final tube diameter, i.e., the outer diameter of the tube of the preform-and-tube assembly. In Pilkington, the preform P is the core of the preform-and-tube assembly (the real preform). And the real preform outer diameter should be the outer diameter of the final tube T, not P.

Third, Pilkington does not teach to measure any tube outer diameter during his whole process.

Further, what Pilkington might imply to measure, from page 3, lines 13-14, 25-31 and page 7, lines 1-8, is exactly as what he states in page 3, lines 30-31:

"the diameter of the core or of the waveguide in the initial preform".

It is *not the outer diameter of any tube* in Pilkington's process.

What tubes Pilkington uses are (page 2, lines 4-5)

"Silica tubes for this purpose are now commercially available in standard size".

The tubes are in standard size and commercially available.

There is no any dynamic measurement of the outer diameters of the tubes in Pilkingotn's process, neither in a middle step for a middle preform (P-T) nor in the final step for the

final preform (P-T).

What Pilkingotn uses and teaches for the tube of the preform-and-tube, i.e., the real preform, in his slight stretch control is

"a first glass *tube* of the waveguide material of *a predetermined diameter* and thickness" (page 3, lines 15-16) [emphasis supplied] and

"a second glass *tube* of the same material of *a predetermined diameter* and thickness (page 3, lines 21-22) [emphasis supplied].

Therefore, *Pilkington does not measure the outer diameter of the real preform, i.e., the tube outer diameter of its preform-and-tube assembly at various locations in his process. It is exact the same case in the prior art of this present invention, i.e., the prior art does not teach the measurement of the preform outer diameter to dynamically control the fiber drawing process. The references use a predetermined diameter of the preform in the fiber drawing process.*

Therefore, from page 3, lines 13-14, 25-31, and page 7, lines 1-8 in Pilkington, he does not teach the measurement of the outer diameter of the P-T, and of course. It is entirely unobvious to measure the outer diameter (T) at various locations for stretching to apply at the locations in his process, because he clearly uses a predetermined diameter as he states in his page 3, lines 15-16 and 21-22.

6. It has been more than decades passed from an early optical fiber drawing process to this present invention. The optical fiber drawing process control is a very complex and large-scale control. A lot of professional skilled people have tried to solve many problems in the process. **A lot of patents regarding the measurements in the fiber drawing process have been issued in the world. However, the fact is that no the prior art references teach measuring the outer diameter of the preform in the fiber drawing process and utilizing the dynamic outer diameter of the preform in the fiber drawing process. Thus, this fact shows that the differences of the subject matter of claim 21 from the prior art including Pilkington as a whole is unobvious at the time the invention was made to a person having ordinary skill in the art in the fiber drawing process.**

7. The last O.A. comments that "Pilkington also does not teach using a control system. It would have been obvious to have an automated system perform the Pilkington method, so as to reduce human error. It is well settled that that is not 'invention' to broadly provide a mechanical or automatic means to reploace manual activity."

**Even if Pilkington method were performed by a control system, this assumed control method would still be clearly different from the present invention control method and substantially lack of the present invention control method and measurement as follows:**

It is known that a control system includes its sensor, its actuator and its control method and principle. Because the Pilkington process lacks the process activities of the present invention, either in a sense of manual activity or in a sense of automatic activity, as listed above in items 1-5, this fact makes the present invention including the control system, as claimed in claim 21, is patentable over Pilkington.

Further, because the significant differences of the process methods and activities between the Pilkington process and the present invention, it is clear that the assumed Pilkington control system and the present invention control system are totally different in the followings:

i. different control objectives and the different scopes as mentioned above: the present invention control system controls the fiber drawing process, while the assumed Pilkington control system would control a preform manufacturing process;

ii. different measuring objects and different measuring data that are detected in the process controls: the present invention control system receives and uses the measurement of the preform diameter or parameter, while the assumed Pilkington control system would use a predetermined diameter of the preform-and-tube assembly as a real preform as whole;

iii. different control actuators: the present invention control system controls fiber drawing process including the preform feeding and the fiber drawing, while the assumed Pilkington control system would not have the preform feeding and the fiber drawing in his teaching;

iv. different control principles, rules and algorithms: such as

- the present invention control system uses the *dynamic outer diameter or geometric parameter of the preform* to control the *fiber drawing process for robust diameter-controlled optical fiber*, including the *preform feeding speed control* and the *fiber drawing speed control*;
- while the assumed Pilkington's control system would use *a static predetermined outer diameter* of preform-and-tube assembly to control the *preform manufacturing* for *enlarging its size*.

Thus, it is clear from the above 7(i)-(iv) and items 1-5 that even if Pilkington method were performed by a control system, this assumed control method would still not show all of the novel and unobvious physical features of claim 21 as stated and analyzed above. Therefore, claim 21 clearly defines patentable subject matter as stated above, including the control system objective, measurement, data, actuator and scope. The key is that the present invention has novel and unobvious physical features that the Pilkington does not show.

8. **Claim 21 recites**:

"measuring either the outer diameter or geometrical shape parameter of a preform; ...

providing a control system with the measured outer diameter or geometrical shape parameter of said preform to control said drawing process".

**Thus, the controlled fiber drawing process can be robustly stable and have robust performance against the variation of the preform outer diameter and shape at different locations including its end of the preform, and variations of various preforms**. It is one of new important results form the present invention. However, the Pilkingotn method will not have this robustness in view of the different scopes, purposes, measurements, control principles, and methods.

9. The O.A. comments that "As to it being 'robustly controlled' and 'high performance' and 'high quality'. It is clear that the Pilkington process is controlled robust enough, with high enough performance and high enough quality to suit the Pilkington purpose. Alternatively: the claim is directed to what 'will' happen; there is no indication as to what

is presently required by the method. What 'will' happen is deemed to be an intended use function which does not require any manipulative difference."

Claim 1 has been rewritten as new claim 21, in which:

i. Terms "high performance" and "high quality" have been replaced by "robust performance" and "robust quality", respectively.

ii. To clarify the robust control and robustness of the present invention process, claim 21 recites:

> "whereby said optical fiber drawing process will be robustly controlled with robust performance of said process and robust quality of said optical fiber, against deviations of the preform outer diameter and shape at different locations and against deviations of various performs, making a robust diameter-controlled optical fiber".

Thus, claim 21 clearly states that the present invention process is "robustly controlled" and has "robust performance" and "robust quality" in the sense of "against deviations of the preform outer diameter and shape at different locations and against deviations of various preforms", that the Pilkington process does clearly lack because he does not have the outer diameter measurement of the P-T assembly and the related features as stated above. On the other hand, the Pilkington process is totally different process from the present invention process.

iii. The clause "whereby said optical fiber drawing process ..." in claim 21 highlights the process over the prior art in function based on the required new steps stated in the present novel method.

Therefore, the key is that the new steps required in claim 21 as recited above make novel and unobvious manipulative difference in the fiber drawing process.

10. **Therefore, from the above items 1-9, claim21 is unobvious as a whole at the time this invention was made to an ordinary skill person in the art**.

**B. Dependent Claims 22-23 Are Unobvious and Patentable Over Pilkington GB 2238536.**

The last O.A. rejected dependent claims 2-3 on Pilkington under 35 U.S.C. 103(a). Claims

2-3 have been rewritten, respectively, as new claims 22 and 23 that define the patentable and unobvious subject matter over Pilkington. Applicant respectfully requests reconsideration of this rejection, as now applicable to claims 22-23, for the following reasons:

New dependent claims 22-23 incorporate all the subject matter of claim 21 and add additional subject matter which makes them a fortiori and independently patentable over Pilkington.

1. **Claim 22 additionally recites:**

> "the measurement of said preform outer diameter or geometrical shape parameter is on-line as a preferred method;
>
> the measured diameter or geometrical parameter is on-line real-time fed to said control system; and
>
> said control system generates a control signal based on the measured perform diameter or geometrical parameter, its deviation from a predetermined nominal value, and said nominal value,
>
> for controlling said process in face of the deviations of the preform diameters or geometrical shape parameters."

**The Pilkington process and "control system"**, as stated, **do not have an *on-line* measurement of the outer diameter or the geometrical shape parameter of the preform**, and, of course, do not have an on-line real-time feeding of the preform measurement to a control system.

2. Moreover, **the novel control principle in the present invention is entirely foreign to Pilkington since, as stated above, his process and "control system" do not apply this novel and unobvious control principle formulated based on the measured perform diameter or geometrical parameter, its deviation from a predetermined nominal value, and said nominal value, as disclosed in the present invention specification and claimed here by claim 22**.

3. On the other hand, **Applicant appreciates the O.A. comment on claim 2**: **"there is no indication as whether the measurement is on-line or off-line"**. The **new claim 22 has taken it into account by choosing "on-line"** as a preferred method and deleting "or off-

line".

4. **Applicant thanks the Examiner for his comment: "Claim 3 refers to feeding the data to the system 'to control the process'. The phrase 'to control the process' reasonably signifies an intention. ... In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art."**

   Now **new claim 23 has taken it into account by rewriting it as manipulative steps that are novel and unobvious over the prior art**, not an intention as follows.

5. **Claim 23 additionally recites:**

   "said control system generates control signals based on the measurement value of the preform, its deviation from a predetermined nominal value, and said nominal value for the process control; and

   the control signals control the process, wherein the control process controls at least one member of the group comprising:

   a feeding speed control of said preform, a drawing speed control of said optical fiber, and a tension control of said optical fiber."

   **This is entirely foreign to Pilkington** since, as stated, the Pilkington process and "control system" do not apply the above novel and unobvious control principle, do not calculate control signals by the measured perform diameter or geometrical parameter, its deviation from a predetermined nominal value, and said nominal value, as disclosed in the present specification and claimed here by claim 23.

   This is also foreign to Pilkington since his process and "control system" do not have the preform feeding speed control, the fiber drawing speed control, and fiber tension control.

**C. Dependent Claims 24-25 Are Unobvious and Patentable Over Pilkington GB 2238536 and Harding US 4793840 or Urruti US 5551967**

The last O.A. rejected dependent claims 4-5 on Pilkington and Harding or Urruti under 35 U.S.C. §103(a). Claims 4-5 have been rewritten, respectively, as new claims 24-25 that define the patentable and unobvious subject matter over these references, and any combination thereof. Applicant respectfully requests reconsideration of this rejection, as

now applicable to claims 24-25, for the following reasons:

1. **As above stated in IV.A.3, the proposed modification and combination is ineffective and inoperative to simultaneously perform Pilkington process and any optical fiber drawing process, including either Harding or Urruti's fiber drawing process.**

2. **The proposed modification of the primary reference destroys the intended purpose of the primary reference's invention – "greatest efficiency"**, i.e., it would be not efficient and mass-productive for either the perform manufacture or the assumed combined fiber drawing process, as stated in IV.A.3 and as highlighted in the followings:

   i. During the Pilkington major repeating process periods, the fiber drawing process must wait for the completion of these periods and can not do any drawing before this completion, because the final perform is not ready during these repeat periods.

   ii. The Pilkington process can not be directly and simultaneously combined with the fiber drawing process (Harding or Urruti or others) because its bottom Rod (R) should be removed from the final top preform (i.e., preform-and-tube assembly) before the fiber drawing process starts. The rod (R) is used to improve the concentricity in Pilkington. Therefore, the Pilkington process can not be simultaneously performed with the fiber drawing process as proposed.

   iii. Therefore, it would be inoperative and inefficient if the proposed combination were performed because of the rod (R) in the bottom.

   iv. Thus, in all, the proposed combination and modification of the primary reference will destroy the main goal "greatest efficiency" in addition to its inoperativeness.

3. **Even if Pilkington process and either Harding or Urruti process were to be combined in the manner proposed, the proposed combination would not show all novel manipulative and physical features of claim 21 as stated in IV.A.4. (i) and (iii) because neither Pilkington, nor Harding, nor Urruti has a measurement of the preform outer diameter or geometrical parameter in their processes.**

4. **Claim 24 additionally recites**

   "measuring the outer diameter of said optical fiber at a position below the furnace",

and "generating control signals based on two different measurement data sets: one from the preform measurement and another from the fiber measurement, their respective deviations from their respective predetermined nominal values, and said their respective nominal values".

Thus, claim 24 incorporates all the subject matter of claim 21 and adds additional subject matter which **makes them a fortiori and independently patentable over Pilkington and Harding or Urruti, further by the above recited novel control principle and novel control signal generation method**.

5. **Claim 25 further recites**

"measuring the outer diameter of said optical fiber as it is being drawn at a position at which shrinkage of the outer diameter of said optical fiber is not larger than a predetermined allowable diameter deviation value of said optical fiber; ... ...

generating control signals ... based on the measured perform outer diameter or geometrical shape parameter, its deviation from a preselected nominal preform diameter or parameter, said nominal preform diameter or parameter, the measured optical fiber outer diameter, its deviation from a preselected nominal fiber outer diameter, and said nominal fiber diameter".

Thus, dependent claim 25 incorporates all the subject matter of claim 21 and adds additional subject matter which **makes it a fortiori and independently patentable over Pilkington and Harding or Urruti because the references further lack this final bare fiber measurement and its corresponding control principle, as well as the novel control principle as listed below.**

6. **Even if Pilkington's method and Harding or Urruti's method were to be combined in the manner proposed, the proposed combination would not show all of the novel manipulative and physical features of claims 24-25.**

In other words, the present invention, as defined and claimed by claims 24-25, comprises much novel and unobvious features that Pilkington and Harding and Urruti lack. The claimed features lacking include:

i. measuring outer diameter of an object to be heated and drawn, i.e., the outer diameter

of the preform;

ii. generating dynamic control signals based on the dynamic outer diameter data of the preform for the fiber drawing process;

iii. the novel drawing process control principle – based on the measured diameter or parameter of the preform, its deviation from a predetermined nominal value, and said nominal value, as described in the present invention specification and claimed by claims 24-25; and

iv. measuring the outer diameter of the fiber at a position at which shrinkage of the outer diameter of said optical fiber, while stretched, is not larger than a predetermined allowable diameter deviation value of said optical fiber.

7. **These new features as stated above are unobvious over the prior art, including the references, especially due to their novel control principles and methods. Thus, claims 24-25 are unobvious over Pilkington and Harding or Urruti.**

8. **The novel features in claims 24-25 provide a robust control against the preform diameter deviation and different shape**, e.g., a larger outer diameter difference at a preform end range. It is especially important when the preform size is becoming larger and larger to raise high productivity. The present invention as claimed in claims 24-25 lets the fiber drawing process not only be robustly stable, but also have robust performance.

9. **The novel features in claim 25 further provide a robust control against the final bare fiber diameter deviation**, to maintain the required product specification when the environment parameters change, including the changes in the furnace, material, physical and chemical factors. It is important when the drawing speed becomes faster and faster.

10. **Thus, from the above items 1-9, the present invention as claimed by claims 24-25 is unobvious over Pilkington and Harding and Urruti, and unobvious at the time the invention was made to a person having ordinary skill in the art**.

11. The last O.A. comments on claims 4-5 that "Pilkington disclosures the invention as claimed, except for the drawing of a fiber. Urruti and Harding disclosed improved methods of drawing fibers from a preform. It would have been obvious to improve the

Pilkington process by using the Urruti or the Harding process to draw the fiber, for the advantages taught in Urruti and Harding."

**However, as stated in IV.A.5, the fact is that *Pilkington clearly does not teach a step of measuring the outermost diameter of final preform in his whole specification. Pilkington clearly does not disclose the present invention as claimed, and as summarized in the following:***

i. From IV.A.5, it can be observed that Pilkington does not teach a step of measuring the outermost diameter of final preform in his whole specification. Pilkington teaches how to increase the preform size by repeatedly sleeving tubers into initial performs and to maintain the concentricity by connecting the rod (R). The final preform-and-tube assembly (P-T) is the preform for the fiber drawing process. The outer diameter of the preform-and-tube assembly (P-T) is the tube diameter. Thus, the outer diameter of the preform in the fiber drawing process is the outer diameter of the tube in the Pilkington process.

   Pilkington states that his process uses

   "**a first glass tube** of the waveguide material **of *a predetermined diameter*** and thickness" (page 3, lines 15-16) [emphasis supplied] and

   "**a second glass tube** of the same material **of *a predetermined diameter*** and thickness (page 3, lines 21-22) [emphasis supplied], ...

   Thus, **it is very clear that a predetermined diameter is used for the tube outer diameter in Pilkington process.**

   **Pilkington does not teach measuring the tube diameter and using the deviation of the tube diameter for his process. Therefore, Pilkington does not teach measuring the outer diameter of the preform (P-T) and using this dynamic measurement for a process control.**

ii. **In the fiber drawing process, the prior art also does not teach measuring the outer diameter of the preform and using this dynamic measurement for the process control. Similarly to Pilkington in his process, the prior art all uses *a predetermined diameter* for a preform.**

iii. **Also, please refer to the above items IV.C. 1-9.**

iv. **Moreover, from the above Section II, all Pilkington and Harding and Urruti are lack of the substantial physical features (a)-(k) of the present invention as listed there. It further proves that Pilkington and Harding and Urruti do not teach the present invention and the present invention is unobvious over the prior art.**

12. The last O.A. comments "Claim 5: as to the fiber being 'within a small percentage'. It would have been obvious to have any shrinkage to be as small as possible – because one wants the measurements to be as accurate as possible. It is noted that glass does not normally shrink."

**The words "within a small percentage" have been replaced by a definite phrase** "at a position at which shrinkage of the outer diameter of said optical fiber is not larger than a predetermined allowable diameter deviation value of said optical fiber", in order to be definite.

In the fiber drawing process, the preform is heated and melted while drawing to form the optical fiber. Thus, the optical fiber (glass) does shrink while stretched due to the heating and melting, the drawing, and the cooling in the fiber drawing process. That was discussed in Yoshimura US 5073179 and the present invention. Due to this matter, Yoshimura and Urruti have presented their inventions to modify the common measurement method in the fiber drawing process. However, the present invention is different from them as stated in II and the specification.

Here the word "shrinkage" is used as specified in the present specification (page 4, paragraph 0014) and being known in the fiber drawing technical area "as used herein, the term 'shrinkage' is intended to mean a ratio of difference in diameters between the optical fiber at the measuring position and the optical fiber once it has finished shrinking".

13. **Applicant thanks the Examiner for the last O.A. comment on claim 5 that** "... based on ... ... Whereas the control might not be the same as the specific control that applicant used, the claims are not limited to the specific embodiment that applicant used."

Claim 5 has been rewritten as new claim 25 to follow the comments.

Applicant appreciates the Examiner's notice that the control might not be the same as the specific control that applicant used. It is really true that the novel control principle and algorithm are disclosed and used in the present invention, and distinguish the present invention from the prior art.

Different control methods and principles make large differences for a control system, process and performance.

The control principle taught *in the prior art* is as described in the specification to use the nominal preform diameter $D$ and the fiber diameter $d$, where the nominal preform diameter $D$ is *a predetermined value*, and only the fiber diameter $d$ is measured in the process and feedback to the control system to make a closed-loop control.

One novel control method of the present invention also reveals *one novel control principle* as disclosed in the specification (pages 16-17, paragraphs 0066-0067), especially expressed by (3) (page 17), i.e.,

> *in addition to measuring the preform diameter* ($D+\Delta D$), the *adjusting amounts of the fiber drawing speed and the preform feeding speed are based on the measurement of the preform diameter* ($D+\Delta D$), *the deviation* ($\Delta D$) *of the preform diameter from the nominal preform diameter* ($D$), *and the nominal preform diameter* ($D$).
>
> *The novel control method and principle are based on the preform diameter* ($D+\Delta D$), *the deviation* ($\Delta D$) *of the preform diameter from the nominal preform diameter* ($D$), *and the nominal preform diameter* ($D$).

**All new claims 21-34 have take this comment into account to define the control methods and principles specifically.** The new claims reflect the novel control methods and principles as described in the present invention specification, such as in pages 9-11, paragraphs 0037–0049, and page 22, paragraph 0095, especially in pages 17-18, paragraphs 0067–0070, and pages 10-11, paragraph 0044.

14. **How to locate sensors to reach an optimal goal for a control system is always a challenging and open problem in control area. It is especially true for a complex and large control system, such as the optical fiber drawing process control.**

**It can be shown by a series of patents have been issued in the fiber drawing process**

**in the world in view of their different sensor locations**, such as the cited references Harding, Urruti, Kenmochi, and Roba, and other references Kokai JP 295260, Yoshimura US 5073179, and Urruti US 5443610 as discussed in the present specification.

**Therefore, how to reasonably locate sensors and what to be reasonably measured in the fiber drawing process are unobvious to a person having ordinary skill in the art.**

15. **From the above reasons listed in IV.C.1-14, claims 24-25 are patentable and unobvious over Pilkington and Harding and Urruti.**

**D. Claims 26, 28-29 and 30 Are Unobvious and Patentable Over Pilkington GB 2238536 and Harding US 4793840 or Urruti US 5551967.**

The last O.A. rejected claims 12, 14-15 and 17-18 on Pilkington and Harding or Urruti under 35 U.S.C. 103(a). Claim 12 has been rewritten as new claim 26. Claims 14-15 have been rewritten as new claims 28-29 respectively. Claims 17-18 have been combined and rewritten as a new claim 30. These new rewritten claims 26, 28-29 and 30 define the patentable and unobvious subject matter over Pilkington and Harding and Urruti. Applicant respectfully requests reconsideration of this rejection, as now applicable to claims 26, 28-29 and 30, for the following reasons:

1. **Different Scope and Content** of the prior art Pilkington as stated in IV.A.1 above.
2. **Differences** between the invention and Pilkington as stated above in IV.A.2.
3. **Proposed modification to simultaneously perform** with the drawing down of the preform-and-tube assembly into optical fiber **will be inoperative and destroy the reference goal** – productivity and greatest efficiency, as stated in IV.A.3 and IV.C.2.
4. **Claimed features lacking**. Even if the combination were to be in the manner proposed, Pilkington and Harding or Urruti would still lack the following substantial manipulative and physical features claimed in Claim 26:
   i. "measuring the outer diameters of said optical fiber, which is bare before the coating, at two or more different locations by respective measurement devices before the coating";

ii. "producing different measurement data sets of the bare fiber respectively from the different locations";

iii. "providing a control system with the different measurement data sets based on that said drawing process is being controlled".

5. The above listed novel features in **claim 26** solve the problem to reduce the measurement time lag and lead, and to increase the measurement accuracy of the final bare fiber outer diameter.

   Therefore, the controlled process can be robustly stable and have robust performance by having a final bare fiber diameter measurement to control the final fiber diameter.

6. Because this second fiber diameter measurement is for the bare fiber, therefore it is better than the Urruti's second measurement on a coated fiber by both the higher measurement accuracy of the final bare fiber diameter and the simpler required measurement technique of the second measurement.

   It is **one of new important results** form the present invention. However, the Pilkingotn and Harding or Urruti method will not have this robustness in view of the different scopes, purposes, measurement methods, control principles and methods.

7. **As stated above, more than decades have been passed since the optical fibers have been drawn. However, no the prior art references teach measuring twice outer diameters of the bare fiber and utilizing the two dynamic outer diameter measurement sets of the *bare* fiber in the fiber drawing process. Thus, it shows that the differences of the subject matter of claim 26 from Pilkington and Harding and Urruti and the prior art as a whole are unobvious at the time the invention was made to a person having ordinary skill in the art in the fiber drawing process.**

8. **The dependent claims 28-29 are a fortiori patentable over Pilkington and Urruti and Harding.**

   New dependent claims 28-29 incorporate all the subject matter of claim 26 and add additional subject matter which makes them a fortiori and independently patentable over these references.

   i. **Claim 28** additionally recites:

"further including a measurement of the outer diameter of said preform above the heating and melting; ... ...

dynamically controlling a preform feeding speed and a fiber drawing speed of said drawing process based on the measured perform outer diameter, its deviation from a preselected nominal preform diameter, and said nominal preform diameter, in addition to the different measurement data sets of the bare fiber".

Again, this control principle is certainly foreign to Pilkington, Harding and Urruti.

ii. **Claim 29**, a dependent claim of claim 28, further defines the two measurement positions of the bare fiber by reciting:

"wherein said two or more different locations include: one at a position below and close to the furnace; and another at a position just immediately before the coating, or at which shrinkage of the outer diameter of said optical fiber is not larger than a predetermined allowable bare fiber diameter deviation value of said optical fiber, therein this measured outer diameter is called a final outer diameter of this bare fiber".

This is totally different from Harding and Urruti who do not have the second *bare fiber* measurement, and of course not this control method using these two bare fiber data sets. This physical feature produces new and unexpected results – not only the accurate feedback, but also a simple measurement technique, and the saving of processing time and storage memory space, with a comparison to Urruti's measurement of the coated fiber. As stated, Urruti uses his second measurement after his first coating. Harding has only one measurement near the furnace. Pilkington does not teach fiber drawing process. Therefore, the above physical feature is entirely foreign to Urruti and Harding and Pilkington, or any combination thereof.

9. **Independent claim 30** specifies the novel control method and principle for the fiber drawing process in this present invention. As stated in the above III.B.1 and III.B.4, claim 30 recites

"*measuring a preform outer diameter ... ...*;

measuring said optical fiber by an outer diameter measurement device located after

said heating and melting stage;

providing the measurement data into a control system which controls a feeding speed of said preform into the heating and melting stage and a drawing speed of said fiber;

*calculating a preform diameter deviation of the measured preform diameter from a preselected nominal preform diameter value*, and a fiber diameter deviation of the measured fiber diameter from a preselected nominal fiber diameter value;

*generating control signals based on the preform deviation* and the fiber deviation for said optical fiber drawing process control; and

*adjusting the feeding speed* of said preform *and the drawing speed* of said fiber *as said control signals command*".

i. **The scope and context are totally different from the primary reference** Pilkington as stated in above IV.A.1.

ii. The proposed **modification destroys the intended operation** due to the bottom rod (R) connected with the top preform in the Pilkington, as stated in IV.A.3 and IV.C.2.

iii. Even if Pilkington and Harding or Urruti were to be combined in the manner proposed, **the proposed combination would not show all above recited specific novel manipulative features of claim 30**, such as measuring a preform in addition to a fiber diameter measurement, generating control signals based on the new control method and principle – the preform diameter deviation data $\Delta D$. Also, it may refer to the above IV.A.4 (i) and (iii), IV.A.5, IV.A.7 (ii) and (iv), and IV.C.11.

iv. The novel features in claim 30 are entirely foreign to Pilkington, Harding and Urruti because the references would lack these feature, also as stated in II.

v. The above facts show that claim 30 is unobvious.

vi. In addition to the above facts, the fiber drawing process development history and a series of issuing patents in the fiber drawing process also show that the present invention is unobvious. Also, please refer to IV.A.6, IV.C.14 and IV. D.7.

**E. New Dependent Claim 27 Rewritten from claim 13 is unobvious and patentable over**

**Pilkington GB 2238536 and Harding US 4793840 or Urruti US 5551967.**

New dependent claim 27 of claim 26 incorporates all the subject matter of claim 26 and adds additional subject matter which makes it a fortiori and independently patentable over these references.

The following features show claim 27 unobvious in addition to the points as stated in the above III.B and IV. D.1-7.

1. Claim 27 further defines the two measurements of the bare fiber and recites

   "a first position close to the furnace; and

   a *second position*, below the first position, at which *shrinkage* of the outer diameter of said optical fiber, while stretched under the drawing, *is not larger than a predetermined allowable bare fiber diameter deviation value* of said optical fiber, *or immediately before the coating*; and

   said control system ... ... calculates the deviations of the two bare fiber measurement data sets from their respective preselected values, and

   dynamically controls a fiber drawing speed and a preform feeding speed for the drawing process based on the deviations of the *two bare fiber measurement data sets* from their respective preselected values".

   This is totally different from Urruti, Harding and Pilkington, or any combination thereof since they do not have the second measurement of the *bare* fiber and, of course, do lack a measurement at this specific region.

2. These two measurements of the bare fiber make the control system maintain a control quality of a final outer diameter of said optical fiber before coating, but also solve a problem of the confliction of the measurement lag and lead in control. As stated in above IV. D.8.(ii), this feature produces new and unexpected results – not only the accurate feedback, but also a simple measurement technique, and the saving of processing time and storage memory space, with a comparison to Urruti's measurement of the coated fiber. This is entirely foreign to Urruti and Harding and Pilkington, or any combination thereof. Thus, claim 27 is unobvious over the references.

**F. New Dependent Claim 32 Rewritten from Claim 19 Is Unobvious and Patentable Over Pilkington GB 2238536 and Harding US 4793840 or Urruti US 5551967.**

1. New dependent claim 32 incorporates all the subject matter of claim 30 and adds additional subject matter which makes it a fortiori and independently patentable over these references.

   Claim 32 further adds a second bare fiber outer diameter measurement device and recites:

   "locating a second bare fiber outer diameter measurement device after the first bare fiber measurement device and before a coating device in which the fiber is coated;

   providing said control system with a second (final) bare fiber diameter measurement from the second bare fiber measurement device;

   calculating a second bare fiber diameter deviation of the measured second bare fiber diameter from a preselected second nominal fiber diameter value which is less than the first nominal fiber diameter value; and

   said control signals are further based on this second bare fiber diameter deviation".

   This is entirely foreign to Pilkington, Harding and Urruti, or any combination thereof since, as stated, the systems of these references do not use the preform diameter deviations, the second diameter measurement data set of the bare fiber, and the novel control principle as claimed in this dependent claim 32 and its independent claim 30.

2. The second bare fiber measurement technique is simpler than the required one by Urruti for his coated fiber measurement because claim 32 measures the bare fiber.

3. These novel features are certainly unobvious over these references in view of the above facts, and the reasons listed in IV.D.7, IV.A.6, and IV.C.14.

## V. New Claims 31 and 33-34 Patentably Define New, Useful and Unobvious Subject Matter Over Pilkington GB 2238536 and Harding US 4793840 or Urruti US 5551967.

**A. New Dependent Claim 31 of Claim 30 Adds Additional Subject Matter – Novel Control**

**Principle – Which Makes It A Fortiori and Independently Patentable Over These References.**

1. Claim 31 further recites

> "said control signals are further based on the measured preform diameter and the preselected nominal diameter in addition to the preform diameter deviation."

This states the novel control principle as disclosed in the specification and distinguishes this claim further from the references. The prior art references including Pilkington, Harding and Urruti do not have this control principle.

It is entirely foreign to these references.

2. This added novel control principle provides the new control method and system with strong robustness against the diameter deviations of one preform or various performs. It lets the controlled fiber drawing process make robust diameter-controlled optical fiber.

3. Please also refer to the above III.B and IV.D.9 related to claim 30.

4. Therefore, this additional subject matter in claim 31 further provides the distinguished subject matter that is new, useful and unobvious as a whole over the prior art, and unobvious at the time the present invention was made to a person having ordinary skill in the art.

**B. Dependent Claim 33 of Claim 32 Incorporates All the Subject Matter of Claims 30 and 32, and Adds Additional Subject Matter – Novel Control Principle – Which Makes It A Fortiori and Independently Patentable Over These References.**

1. Claim 33 adds additional subject matter as recited as follows:

> "said control signals are further based on the measured preform diameter and the preselected nominal diameter in addition to the preform diameter deviation;
>
> thus, said control signals are based on the measured preform diameter, the deviation of the measured preform diameter, the nominal preform diameter, the first bare fiber diameter deviation, and the second bare fiber diameter deviation".

It is a novel control principle for the fiber drawing process. This novel control principle

is entirely foreign to these references.

2. This new additional feature produces very strong robustness against the deviation of one preform or various preforms, and various disturbances and perturbations affecting on the bare fiber diameter in the fiber drawing process.

3. Therefore, this additional subject matter in claim 33 incorporated with all the subject matter of claims 30 and 32 further provides the distinguished subject matter that are new, useful and unobvious as a whole over the prior art, and unobvious at the time the present invention was made to a person having ordinary skill in the art.

4. Please also refer to the above III.B, IV.D.9 , IV.F and V.A.

**C. New Dependent Claim 34 of Claim 33 Incorporates All the Subject Matter of Claims 30 and 32-33, and Adds Additional Subject Matter Which Makes It A Fortiori and Independently Patentable Over These References.**

1. Claim 34 further recites

> "the control signals are further based on fluctuation data from the current measurements and measurement history data over a period;"

This is clearly a novel feature over the references because the references do not teach this control method, and, especially, the history data include the preform measurement data and two bare fiber measurements data sets.

2. This new additional feature together with all the subject matter in claims 30 and 32-33 makes the new robust control performance and function as recited

> "whereby the process control provides robust performance of the drawing process and robust quality of the fiber further against the fluctuations of the diameters, time-lag and time-lead of said measurements corresponding to the heating and melting stage, and environment fluctuations of the heating and melting."

3. Therefore, this additional subject matter in claim 34 further provides the distinguished subject matter that are new, useful and unobvious as a whole over the prior art references and unobvious at the time the present invention was made to a person having ordinary skill in the art. Please also refer to the above III.B, IV.D.9, IV.F and V.A-B.

## VI. Claims 21-34 Define Patentably Novel (and Unobvious) Manipulative and Physical features Over Roba US 6371394, Gansicke US 6516636, Kenmochi US 6178778, or Any Combination Thereof.

The last O.A. also comments that "Roba, Gansicke, Kenmochi are cited as showing other two diameter measurement techniques" and "pertinent to applicant's disclosure". However, as stated in the above II, all these references lack the novel features (a)-(k) of the present invention. New claims 21-34 define patentably over these references, and any combination thereof. Applicant respectfully request reconsideration of this matter for the following reasons:

**A. Gansicke Is in Different Scope and Content.** It regards a tube manufacture.

**B. Robu and Gansicke and Kenmochi Do Not Contain Any Justification to Support Their Combination.**

With regard to any combination of Robu, Gansicke and Kenmochi, it is well known that in order for any prior-art references themselves to be validly combined for use in a prior-art § 103 rejection, the references themselves (or some other prior art) must suggest that they be combined, e.g., as was stated in In re Sernaker, 217 U.S.P.Q. 1.6 (C.A.F.C. 1983). These references do not contain any suggestion that they be combined, or that they be combined in the manner suggested.

**C. Even If the References Roba, Gansicke and Kenmochi Were to Be Combined in the Manner Proposed, the Proposed Combination Would Not Show All of the Novel (and Unobvious) Claimed Features in Claims 21-34.**

All these references are briefly summarized in the above II, especially regarding their different measurement techniques. It is noticed that all these references Kenmochi, Gansicke and Roba do lack the following novel claimed features that are claimed in claims 21-34 as concisely recited above in III—V and as briefly summarized as follows:

1. The *preform* diameter or shape parameter measurement in the fiber drawing process;
2. The *two measurements of the bare fiber at two different locations* and their corresponding *two different data sets*;

3. The *novel control operation principle using the preform measurement, its deviation from a preselected nominal value, and this nominal value*;

4. The *novel control operation principle* using *two different diameter measurement data sets of the bare fiber* from the two different locations, their respective deviations from their respectively preselected values;

5. The *final bare fiber diameter measurement at a location* at which shrinkage of the outer diameter of said optical fiber, while stretched under the drawing, is not larger than a predetermined allowable bare fiber diameter deviation value of said optical fiber, or *immediately before the coating*.

**D. The Above Stated Novel Claimed features Make Advantages Over These References.**

1. The fiber drawing process is robustly controlled and stable with robust performance against the deviations of the *preform* diameter or shape in a preform or various preforms.

2. It is especially important when the preform becomes larger and larger in size.

3. Moreover, it is extremely important for the fiber drawing process during a period of drawing at the end of the preform in view of the shape and size.

4. The process has robust performance against the process physical and chemical factor fluctuations, disturbances, parameter perturbations, and environment changes, to solve a defect of one bare fiber measurement in either measurement lag or lead, and to have an accurate final bare diameter measurement and its control, by utilizing two different measurement data sets of the *bare fiber* for the process control.

**E. Roba, Gansicke, and Kenmochi Do Not Show Two Diameter Measurements of the Bare Fiber. On the Other Hand, This Fact Does Show that *the Present Invention Has Novel Useful* and *Unobvious Measurement Features and Operation Principles*. Therefore, the Present Invention Is Patentable and Unobvious Over the Prior Art.**

1. Roba teaches his measurements as follows: one after the furnace and before the cooling and the coating; one after the first coating; and one after the second coating.

2. Gansicke measures the tube as follows: one in the furnace and one after furnace in his tube manufacture process.

3. Kenmochi does measurements at two locations: one in the furnace and one after furnace.
4. *They all measure only one time after a furnace and before any coating.*
5. *Neither of them measures the preform before the furnace. Neither of them measures the bare fiber twice at two different locations after the furnace and before the (first) coating.*
6. *Applicant honors their various patented measurements and contributions. However, they never disclose the subject matter in the present invention as stated in the above item C.*
7. Thus, the present invention as disclosed and claimed is novel and unobvious over the prior art and useful for the fiber drawing process.

**F. New Principles of Operation and Control in the Fiber Drawing Process.**

1. As mentioned above in V.A-C and VI.C.3-4, the present invention utilizes new principles of operation and control in the fiber drawing process.
2. Neither of these references teaches these novel control principles of the present invention.

**G. Claims 21-34 in the Present Invention Are Unobvious Over Roba, Gansicke, Kenmochi Or Any Combination Thereof in View of A Series of the Issued Patents.**

1. A series of issuing these patents also further show that different measurements in a large complex process and control are challenging and unobvious to a person having ordinary skill in the art.
2. Applicant honors their various new patented measurements and contributions.
3. Therefore, from the above VI.A-F and in view of a series of issuing these patents, the present invention has the novel subject matter that is different from the prior art and unobvious as a whole at the time this invention was made to a person having ordinary skill in the art.

## VII. Further Factual Evidences to Show the Present Invention New, Useful and Unobvious

**A. Optimal Sensor Location Problem Is Always a Challenging and Open Problem in the**

**Area of Control and Systems.**

It is especially true for the complex optical fiber drawing process control. Applicant highly values and honors all references patents, many of that are using different located sensors.

**B. A Series of Issuing These Patents in the Fiber Drawing Process Show that the Subject Matter of the Meaningful and Effective Sensor Locations in the Optical Fiber Drawing Process is Patentable and Unobvious.**

**C. The Present Invention Has Substantial Novel Measurement Method Differences From the Prior Art as Stated above in II–VI, thus It Is Patentable and Unobvious.**

**D. The Present Invention Has New Control Methods and Novel Operation Principles as Stated above in II–VI, and is Patentable and Unobvious.** New principles of operation and control are different as featured in the invention from all the references and the prior art.

**E. The Present Invention Provides Robust Control Quality and Robust Process.** It is especially for the period in which the ends of the preform are drawn because the ends have different shape from the nominal value. The invention can make the drawing process robustly stable with robust performance against various material and environment changes.

**F. Robustness Issue. Applicant Has Been Consulted by Some Optical Fiber Manufacture Company Regarding the Robustness Issue of the Optical Fiber Drawing Process.** This present invention can further solve various robustness requirement issues and problems in the fiber drawing process. Thus, it also reflects that **the present invention is unobvious**.

**G. Professional Recognition** – The invention has been given an award and recognition by the University of North Carolina at Charlotte. (Please see the attached copy.)

**H. Competitive Recognition** – Recently, some foreign (and non-China) company filed a patent application in China, the content of that is basically similar and close to this present invention as they recognized. They have read and checked the applicant's this patent application in China, for that the applicant applied as an international patent application in 2002 following the US PTO permission notice to this US patent application. (Please see the attached copy.)

**I. Some Foreign Company Intended to Purchase the Present Invention and Application.**

An agent company contacted the applicant on behalf of that foreign company, and said that foreign company had intended to purchase the present invention and application of the applicant. (Please see the attached copy.)

## Ⅷ. Respectful Request for Reconsideration

From all of the above, it can be seen that the substituted claims of the present invention are patentable over the prior art. Therefore, Applicant respectfully requests reconsideration of the present invention.

## Ⅸ. Conclusion

The present invention includes the new patentable subject matter in optical fiber drawing process. In a very brief summary, these novel, useful and unobvious claimed manipulative and physical features over the prior art as a whole include: measuring preform outer diameter, using new robust control method and new operation principle involving $\Delta D$ (a deviation of a preform outer diameter from its nominal value), $D+\Delta D$ (the dynamic preform measurement) and $D$ (the nominal value), having two different diameter measurements of the bare optical fiber by two measurement devices at two different locations below the furnace and above any coating device, using new operation principle including two different diameter measurement data sets of the bare fiber, one set of that is related to the desired final bare fiber diameter, as stated above.

For all of the above reasons, applicant respectfully submits that the claims are now in proper form, and that the claims all define patentably over the prior art.

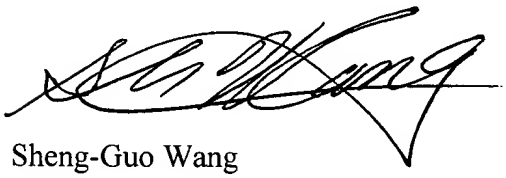
Therefore applicant submits that this application is now in condition for allowance, which action he respectfully solicits.

## Ⅹ. Conditional Request for Constructive Assistance

Applicant has amended all claims of this application so that they are proper, definite, and define novel structure which is also unobvious. If for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and

suggestions of the Examiner pursuant to MPEP §706.03(d) and §707.07(j) in order that undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

Very respectfully,



Sheng-Guo Wang

---------- Applicant Pro Se ----------

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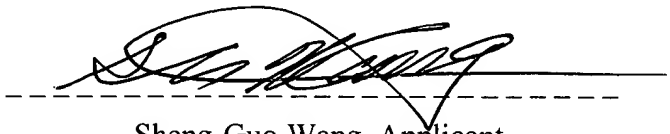
**Certificate of Mailing:** I certify that on the date below this document and referenced attachments, if any, will be deposited with the U.S. Postal Service as the express mail in an envelope addressed to: "COMMISIONER FOR PATENTS, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450."

2004 Oct. 18 

Sheng-Guo Wang, Applicant

## Substantial Feature Comparison Table

**(Dr. Sheng-Guo Wang 10-18-2004)**

| | **Optical Fiber Drawing Process** | **Measurements at different locations for** | | | Feed speed control using Preform dynamic data | Drawing speed control using Preform dynamic data | Tensor control using Preform dynamic data | Feed speed control using two different bare fiber diameter data sets | Drawing speed control using two different bare fiber diameter data sets | Tensor control using two different bare fiber diameter data sets | New robust control method law |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Preform outer diameter** | **Bare Fiber Just after heating** | **Bare Fiber Just before coating within limited shrinkage** | | | | | | | |
| The Applicant's Invention (US) | X | X | X | X | X | X | X | X | X | X | X |
| | X | X | | X | X | X | X | | | | X |
| | X | X | X | | X | X | X | | | | X |
| | X | X | | | X | X | X | | | | X |
| | X | | X | X | | | | X | X | X | X |
| Pilkington (GB) GB 2238536 | Preform manufacture | | | | | | | | | | |
| Harding (GB) US 4793840 | X (only 1M) | | X | | | | | | | | |
| Urruti (US) US 5551967 | X (1 after furnace & 1 after coating ) | | X | | | | | | | | |
| Kenmochi (JP) US 6178778 | X (2 M in furnace, & 1 after heating) | | X | | | | | | | | |
| Gansicke (DE) US 6516636 | Tube manufacture (1 in & 1 after furnace) | | (x) not fiber | | | | | | | | |
| Roba (IT) US 6371394 | Winding fiber (X) | | X | | | | | | | | |

UNC CHARLOTTE

IN RECOGNITION

OF

# SHENG-GUO WANG

INVENTOR

For

UNC Charlotte Invention

***Robust Diameter-Controlled Optical Fiber During Optical Fiber Drawing Process***

Provisional Patent Filed: November 14, 2000

# 深聯商業貿易進出口代理中心

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王胜国同志：

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我代理中心在会场上安置开放了22台宽带互联网电脑，供参加会议的企业领导专门查阅高新技术信息。

现有本省内一家外资企业向国家知识产权局申报专利，与你的专利申请“光纤抽丝过程中母棒直径控制的光纤”内容基本相近，你该专利申请尚未领到专利证书，但公司经理急于考虑这个冲突，有意协商购买这个技术和专利申请，有《受理通知书》可开展洽谈工作。已委托我方代理中介业务。

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你的专利资料是公开的，我方已在中国知识产权局查到你的该专利资料，意向方也有代表人阅过，当我收到你的联系，我会马上开展下一步工作，希望能得到你的配合。

我们向你方承诺：我单位在成功前不向你方收取任何费用，但在成功后，我方向你方收取成交总额的３%作为中介收入。

此致！

深联商业贸易进出口代理中心

联系人：李华清

主任：黄天成

二００四年七月八日

***Shen Lian Business Trade Export & Import Agency***

Address: Shen Lian Building, Shekou Industrial Zone, Shenzhen, Guangdong Zip: 518067
Tel.: 0755-81597411 Digital Fax: 013926580133

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Mr. Sheng-Guo Wang:

Our Agency provides uncommon opportunities for intangible assets transfer when we are doing business exports and imports.

Our Agency has set up 22 broad-band internet-connected computers for company leaders who attend conferences to review new high-tech information.

Now there is a foreign company in our province submitting an application for a patent to the State Intellectual Property Office of PRC, that is basically similar and close to the content of your patent application "Robust diameter-controlled optical fiber during optical fiber drawing process". Your patent application has not been issued the patent certificate. However, this company manager is urgent to consider this conflict, and is willing to negotiate to purchase your this technology and patent application. With your Official Filing Receipt, it is able to start the negotiation. This company has designated our Agency to do this business.

Now we are asking for your opinion. If you have an intension to transfer this patent right, please call us at 0755-81597411in 10 days after you receive this letter. This matter is handled by our Chief Officer, his mobile phone number: 013554775259, fax: 013926580133 (this digital fax can also receive normal fax). Please indicate this patent file serial number in computer: PX 1708 when you call us.

Your patent material is open to the public. We have searched your patent material at the State Intellectual Property Office of PRC. The intended party has also reviewed your patent material. When I have got your contact, I will immediately start next stage work. I hope to have your cooperation.

We promise to you: our Agency will not charge you any costs before success, but after the success, we will charge you 3% of the total amount of the deal as an agent fee.

Sincerely,

Shen Lian Business Trade Export & Import Agency
Liaison person: Huaqing Li
Chief Officer: Tianchen Huang

July 8, 2004

(Company Stamp) **Shen Lian Business Trade Export & Import Agency**

**Record of the Substance of the Interview**

Participants: Examiner: John Hoffmann
Applicant: Sheng-Guo Wang

Date: 8-30-2004

I. First the Applicant expresses his thanks to the Examiner for the advice to submit the response when the Applicant was out of the country in May 2004 and the comments regarding 35 U.S.C. 112, especially for all constructive comments.

II. The Applicant expresses his hope to work together and work out today.

III. All comments regarding 35 U.S.C. 112 have been taken into amending claims. All previous existing claims have been canceled and newly amended claims have been presented.

IV. The Applicant gives a very briefly summary and statement of his invention for the optical fiber drawing process. The invention includes new key steps in optical fiber drawing process, such as measuring preform outer diameter, using new robust control method and new operation principles, involving $\Delta D$ (a deviation of a preform outer diameter measurement from its nominal value) ..., and having two diameter measurements of the bare optical fiber by two measurement device at two different locations below the furnace and above any coating device, etc.

V. The Applicant also distributes:

1. a copy of proposed Amended Claims, original Specification, and original Figure Sheets;

2. a copy of relevant pages of the applied references (Pilkington, Harding, Urriti, Kenmochi, Gansicke, Roba, Little);

3. a Substantial Feature Comparison Table;

4. a copy of the Professional Recognition from the University of North Carolina at Charlotte to the inventor for the invention; and

5. a copy of letter of July 8, 2004, showing an intending purchase offer from an agent company serving for a foreign company.

VI. Claims discussed: All

VII. Identification of prior art discussed:

| | |
|---|---|
| Pilkington (GB) | GB 2238536 |
| Harding (GB) | US 4793840 |
| Urruti (US) | US 5551967 |
| Kenmochi (JP) | US 6178778 |

| | |
|---|---|
| Gansicke (DE) | US 6516636 |
| Roba (IT) | US 6371394 |
| Little (GB) | GB 2146321 |

VIII. Identification of the principal proposed amendments of a substantive nature discussed:

Canceled previous existing claims and proposed new claims that with clear substantive new nature and features as described in the specification.

(Please refer to the below record).

IX. Brief identification of the general Thrust of the principal arguments presented to the Examiner:

Urruti, Harding, Kenmochi, Gansicke, Roba and Little processes have no preform outer diameter measurement. Furthermore, they have no two different measurements and two measurement data sets for the bare optical fiber below the furnace and above the coating (coater).

Pilkington does not teach measurement of the final preform outer diameter, i.e., its tube outer diameter, during its process. Furthermore, that is of different scope and content from the invention. He uses "a predetermined diameter" (commercial standard size) of a tube for his process and control.

The invention has new operation principles of the fiber drawing process control based on $\Delta D$ (the deviation of the preform outer diameter), $D+\Delta D$ (the preform measurement) and $D$ (its nominal value), and two different outer diameter data sets of the bare fiber, and their combinations.

They are summarized by the Substantial Feature Comparison Table.

(Please refer to the below record.)

X. Previous Claims 7-10 have been canceled. The Applicant expresses a thought to amend a new claim with the new key feature of measuring a *bare* fiber outer diameter just above a coating device.

The applicant expresses his thanks to the Examiner for his commenting on Claim 10 that "It is noticed that it appears that Applicant intends to claim two different sets of outer diameters – however, the claim does not provide much or any difference between the two diameters being used. In other words, the claims are very broad and read on only one diameter measurement device." This comment has been taken into all related amending.

XI. The Applicant explains features in the claims are not shown in the prior art (35 U.S.C. 102) and why they are patentably significant:

1. New proposed amended Claims 26-27 (from the previous Claims 12-13 respectively)

have the following features that Urruit 5551967 does not have:

a. measuring the outer diameters of said optical fiber which is bare before coating at two or more locations by respective measurement devices before the coating; and

b. providing a control system with two or more different measured outer diameter data sets of said optical *bare* fiber from said two or more measurement device locations to control said drawing process.

2. Urruit 5551967 teaches only one measurement for the bare optical fiber before the coating. Its second measurement is made just after coater 54.

3. Claim 27 further recites detail prefer locations for two measurements.

4. These different key features provide better sensor data for the control system because their measurements are bare fiber diameters that are required for the robust control; while Urruit's second measurement is the coated fiber diameter that is different from the bare fiber diameter.

5. The differences of the proposed amended claims are not only different steps and features, but also different control principle by two different diameter data sets of the bare fiber that is drawing in the drawing process.

6. In Urruit, col. 4, lines 33-67, the second measurement is made just priot to coater 56, but is after coater 54. Therefore, he measures a coated fiber diameter, i.e., a "clothed" fiber diameter by the second measurement. It is different from the invention to measure the bare fiber diameter at the second different location.

7. A new proposed amended Claim 31 [newly named as claim 32] (from the previous Claim 19) has the following features of the control method that Urruit 5551967 does not have:

as in this Applicant's Claim 30,

a. "measuring a preform";

b. calculating their respective deviations of the measurement data from their respective predetermined nominal values;

c. control adjustment based on the preform outer diameter deviations;

and in Claim 31 [newly named as claim 32] itself,

d. the second measurement of the bare fiber diameter and its following different control method steps;

e. the different control principle and method.

8. These key features make the invention have robust control performance against the deviation of the preform outer diameter, the furnace temperature, the measurement data lag and lead affects.

XII. The Applicant explains the claims are not obvious from the prior art (35 U.S.C. 103) and why they are patentably significant.

1. Claims 21-23 amended from previous Claims 1-3 are unobvious from prior Pilkington GB 2238536.

a. *Different Scope and Content of* prior art Pilkington:

Pilkington 2238536 is for manufacturing performs by repeatedly collapsing the tubes onto the initial preform to increase its size and maintain the concentricity.

It is a different manufacturing process from a fiber drawing process. His innovation mainly is for the sleeving processes through the successive addition of the commercial tubes. However, Pilkington has different scope and content from the present invention.

b. *Differences between the invention and Pilkington:*

i. Pilkington does not teach to measure the real preform outer diameter that should be its tube diameter.

ii. The invention is a new fiber drawing process with many novel features.

iii. The invention uses the final preform outer diameter measurement for the fiber drawing process control.

iv. This fiber drawing process control includes preform feed speed control, fiber drawing speed control and fiber tensor control.

c. *Proposed modification will destroy the reference goal -- productivity:*

i. It will not be efficient.

ii. Not suitable for mass production because

- Pilkington's preform process is a repeat process;
- Its repeat process is using the same apparatus;
- The fiber drawing process had to wait for finishing this repeat process.

iii. Moreover, its process can not be directly combined with the fiber drawing process because its bottom Rod should be removed from the final top preform before the fiber drawing process is started. So, it can not be simultaneously drawing fiber from the final preform while collapsing the final tube onto the initial-preofrm. The Rod has no optical core and can not build the required optical fiber.

d. *Claimed features lacking: Pilkington process has –*

i. No final preform diameter measurement;

ii. No preform feed and its control;

iii. No drawing speed control;

iv. No tensor control; and more important,

v. No new process control principle as the Applicant disclosed by the preform outer diameter deviation, the measurement and its nominal value in algorithm expression (3) in the invention Specification.

The fiber drawing process is of large stretch and large material size change.

e. So, the Claims are unobvious as a whole at the time this invention was made to an ordinary skill person in the art.

2. Claim 22 selects on-line measurement to follow the comment. The Applicant thanks to the Examiner.

3. Claim 23 is amended from Claim 3 by using the suggested sentence and adding control method content. During the interview, the applicant also asks the possibility to use word "comprising".

4. Claims 24-25 are unobvious from Pilkington and Harding 4793840 or Urruti 5551967:

a. As explained above, the claims are unobvious from Pilkington.

b. Because the Pilkington process does not measure the real final preform outer diameter as discussed above, therefore using the Urriti or the Harding process still misses a key feature of measuring the preform outer diameter.

c. Furthermore, the Urriti or the Harding process is lacking of the claimed new fiber drawing process control principles as listed in IV and IV.

d. As above explained, the combination of the Pilkington process with the Harding or Urriti drawing process destroys the goal of intended purpose of the references.

e. So, the Claims are unobvious as a whole at the time this invention was made to an ordinary skill person in the art.

5. Claim 25 has amended previous words "within a small percentage" by "not larger than a predetermined allowable diameter deviation value of said optical fiber". The Applicant expresses his thanks to the comment.

6. Amended new Claims 26, 28-29 and 30 from previous claims 12, 14-15, and 18 are unobvious over Pilkington in view of Harding or Urruti.

   a. As above explained.

   b. No preform diameter measurement.

   c. No twice measurements of the bare fiber at two different locations and their corresponding two different data sets.

   d. Different control methods and operation principles.

   e. So, the claims are unobvious.

7. The Applicant thanks to the Examiner for the comments regarding "written as intended result – with no corresponding manipulative steps which result in the intended result" and "express only relative results".

   The corresponding manipulative steps which result in the intended result have been recited into the claims, such as "generating control signals", "dynamically controlling a preform feeding speed and a fiber drawing speed", "adjusting ...", "calculating ...".

   Further, the indefinite claims are cleared and specified. Words "in view" of shrinkage have been removed.

XIII. The applicant further expresses as follows:

1. Optimal sensor location problem is always a challenging problem and an open problem in the area of control and systems. It is especially true for the complex optical fiber drawing process control.

2. The applicant highly values and honors all references patents, many of that are using different sensor locations.

3. A series of issuing these patents show that the subject matter of the meaningful and effective sensor locations in the optical fiber drawing process is patentable and unobvious.

4. This invention has substantial method differences from the prior art.

5. The invention provides robust control quality and process. It is especially for the period in which the ends of the preform are drawn because the ends have different shape from the nominal data. The invention can make the drawing process robustly stable with robust performance against the material and environment changes.

6. The invention has new control methods and novel operation principles as mentioned above. New principles of operation and approach are different from the references, as featured in the invention.

7. Professional recognition – The invention has been given an award and recognition by the University of North Carolina at Charlotte. (Please see the copy.)

8. Competitive recognition – Recently, some foreign (and non-China) company filed a patent application in China, the content of that is basically similar and close to the present invention as they recognized. They have read and checked the applicant's this patent application in China, that the applicant applied for following the US PTO permission notice to this US patent application. (Please see the copy.)

9. Some foreign company intended to purchase the present invention and application. (Please see the copy.)

XIV. General indication of any other pertinent matters discussed:

The applicant asked difference between consisting and comprising, and discussed to use comprising.

The applicant was advised to submit the Amendment before or on the required time.

XV. General results or outcome of the interview:

The Applicant will further modify some claims.

Following the Examiner's advice, the Applicant will submit Amended Claims with explanations and arguments corresponding to the last OA.

The Examiner said it will be considered when filed as an Amendment and with Arguments.

Respectfully submitted by the applicant 

Dr. Sheng-Guo Wang 10-16-04